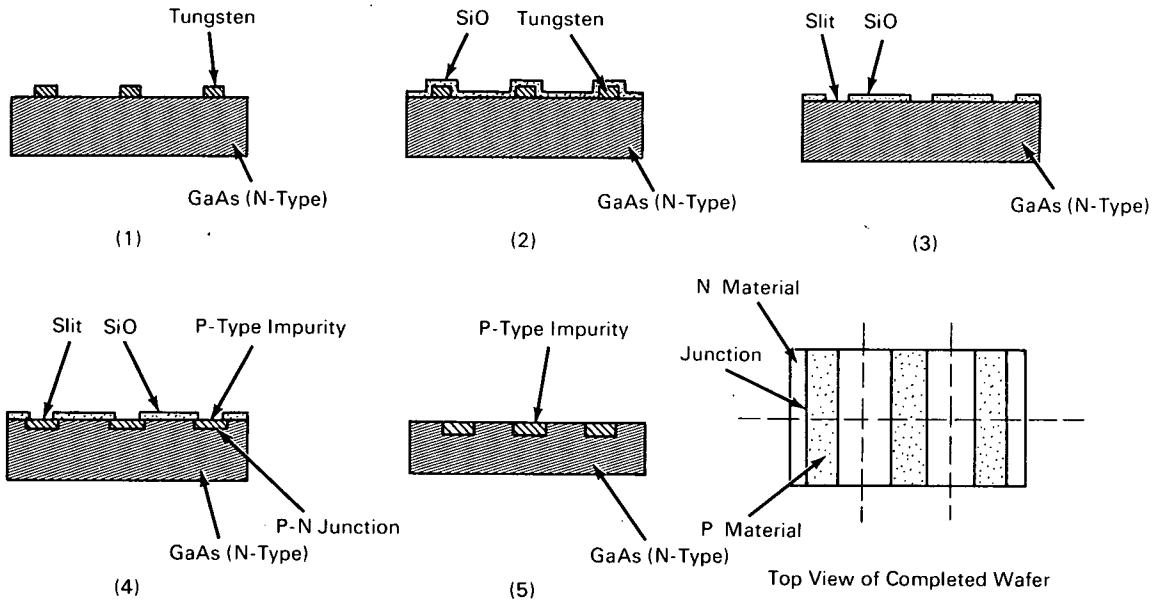
August 1969

Brief 69-10271

NASA TECH BRIEF

Improved Method of Fabricating Planar Gallium Arsenide Diodes



An improved, simple method has been devised for fabricating electroluminescent (light-emitting) planar P-N GaAs (gallium arsenide) diodes. The planar-type GaAs diode emits substantially equal amounts of light from its P and N sides, whereas the light from the P side of a common mesa-type GaAs electroluminescent diode has approximately half the intensity as the light from the N side of a mesa-type diode made by diffusing P-type impurities into the entire surface of the N-type GaAs wafer to form a P-N junction. The lower intensity of light from the P side of such a mesa-type GaAs diode is due to the fact that the light absorption coefficient of the P-type material is much higher than that of the original N-type GaAs.

Conventional techniques for fabricating other types of planar diodes cannot be used in fabricating a planar GaAs diode. For example, silicon dioxide, which is extensively used as a maskant in the fabrication of planar silicon diodes and other semiconductive components, cannot be thermally grown on GaAs or evaporated onto it at a temperature low enough (below about 400°C) to prevent the dissociation of the GaAs. In the new method, the GaAs is masked with SiO (silicon monoxide) to allow P-type impurities to be diffused in unmasked portions of the GaAs to form P-N junctions. The deposition of SiO is performed below the dissociation temperature of GaAs. A first step (1) in fabricating the planar GaAs diode is to place on the GaAs wafer a number of strips of material (e.g., tungsten) which do not react with GaAs or SiO. In the second step (2), a layer (5000 to 8000 angstroms) of SiO is vapor-deposited over the tungsten strips and

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exposed surface of the GaAs wafer. In step (3), the tungsten strips with the SiO deposit on them are removed, leaving a series of unmasked openings or slits in the SiO deposit on the GaAs wafer. In step (4), P-type impurity, such as zinc or cadmium, is diffused into the GaAs wafer through the slits, forming P-N junctions. After the diffusion is completed, the SiO mask is etched away, step (5), with an appropriate solution (e.g., a hot concentrated solution of hydrofluoric acid) and washed with water. The resultant wafer may be divided into smaller segments or chips to form a number of individual diodes. For example, the dotted lines in the top view of the completed wafer indicate the division of the wafer into six diodes, each with a channel-like diffusion of P material in the surface of N-type GaAs.

Note:

Documentation is available from:
Clearinghouse for Federal Scientific and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: TSP69-10271

Patent status:

No patent action is contemplated by NASA.

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